Name: _____ ATSC 201 Midterm Student Number: _____

Fall 2022

Open books, notes, laptop, epad, calculator. (Communications with other people is NOT allowed.)
OK to separate all the sheets. Put your Name & ID on all sheets. Do NOT re-staple.
Turn in all question sheets, thermo diagrams, hodographs, and bubble sheet.
Please use the bubble sheet to indicate your answers. Only the bubble sheet will be marked.
Total of 19 questions (worth 50 points). Roughly 1 point per minute.

The following sounding is already plotted on the attached thermo diagram. Use the plotted diagram to answer questions 1 - 12.

P (kPa)	T (°C)	Td (°C)
20	−45	
25	−45	
35	−35	
50	−15	
70	10	
78	10	
95	22	
100	36	10.5

Question (points)

1 (2) At what pressure (kPa) is the lifting condensation level (LCL)?

A	B	C	D	E
70	75	78	85	90

2 (2) At what pressure (kPa) is the level of free convection (LFC)?

A	B	C	D	E
100	95	78	73	62

3 (3) At what pressure (kPa) is the equilibrium level (EL)?

A	B	C	D	E
51	43	35	27	19

4 (2) At what pressure (kPa) is the top of the mixed layer?

A	B	C	D	E
100	95	78	73	62

5 (2) At what pressure (kPa) is the bottom of the convective inhibition (CIN) region?

A	B	C	D	E
100	95	78	73	62

6 (3) The CAPE area is 24.5 (°C·km). What is the value of CAPE () for this sounding?

A	B	C	D	E
0.949	94.9	949	1949	2949

7 (2) What is the thunderstorm threat for this sounding? (assume CAPE from (1f) is MLCAPE)

A	B	C	D	E
no CB	ordinary (weak) CB	marginal CB supercell	supercell (severe CB, no tornado)	tornadic supercell (severe CB)

8 (3) What is the static stability of the environment between P = 78 and 75 kPa?

A	B	C	D
stable	near neutral	unstable	(not enough info to answer)

9 (2) What is the relative humidity (%) of the environ. air at the surface?

A	B	C	D	E
20	27.8	37.5	45	100

10 (2) What is the total water mixing ratio (g/kg) of the air parcel at its LCL?

A	B	C	D	E
8	16	40	70	100

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Question (points)

11 (2) What is the wet-bulb temperature (°C) of the air near the surface (at P=100 kPa)?

A	B	C	D	E
5	10	15	20	36

12 (2) What is the potential temperature (°C) of the environment at P = 35 kPa?

A	B	C	D	E
−35	−27	2	17	48

13 (5) What is the value of Coriolis parameter (10^{-4} s^{-1}) at the Tim Hortons restaurant in Alert, Nunavut (on Ellesmere Island). (lat/lon ≈ 82.5°N, 62.35°W)

A	B	C	D	E
0.725	0.935	1.15	1.35	1.45

14 (3) If a constant-thickness layer of air starting at Alert at has zero relative vorticity, but then it moves south to Newfoundland/Labrador (latitude ≈ 53°N), then its relative vorticity will _____and the direction of rotation will be _____ .

A	B	C	D	E
decrease	decrease	zero	increase	increase
clockwise	counterclockwise	(no rotation)	clockwise	counterclockwise

15 (2) Which answer has the phenomena at the correct locations relative to a thunderstorm?

	A	B	C	D	E
Near top	mammatus	mammatus	haboob	gust front	anvil
Near bottom	anvil	wall cloud	arc cloud	haboob	mammatus

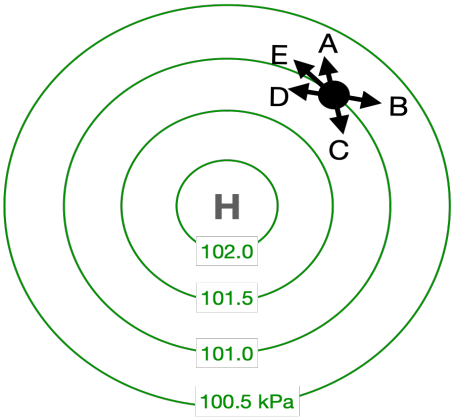
16 (3) What is the virtual temperature of air that has a temperature of 30°C and mixing ratio of 25 g/kg.

A	B	C	D	E
30.5	34.6	487.5	4,651	4,620,780

17 (3) A layer of dry air between 100 and 90 kPa has T = 20°C. What is the layer thickness?

A	B	C	D	E
61.74 m	90.4 m	0.75 km	0.9 km	6.1 km

18 (2) Given the high-pressure center in the Northern Hemisphere as sketched in the figure at right, which arrow shows the wind vector in the boundary layer?



19 (5) Given the wind data below, plot them on the blank hodograph attached, and graphically estimate the "normal" thunderstorm motion.

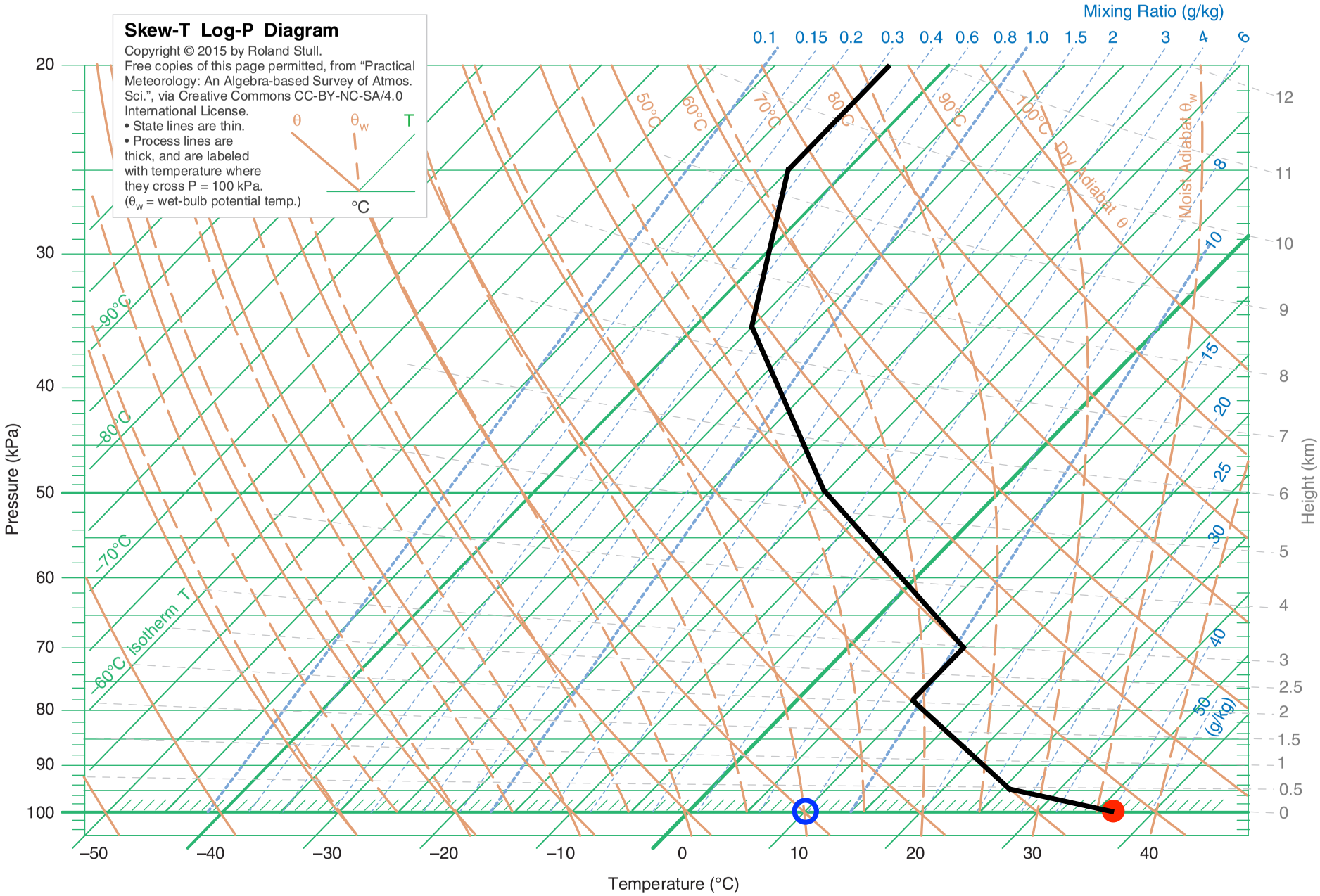
z (km)	direction(°)	speed (m/s)
6	330	30
5	310	20
4	280	15
3	260	13
2	240	10
1	220	5
0	0	0

The normal storm motion [direction(°) , speed(m/s)] is:

A	B	C	D	E
203, 10	23, 9	103, 12	260, 13	293 , 11

(50) total points

-- End of Exam. See attachments. --


Skew-T Log-P Diagram
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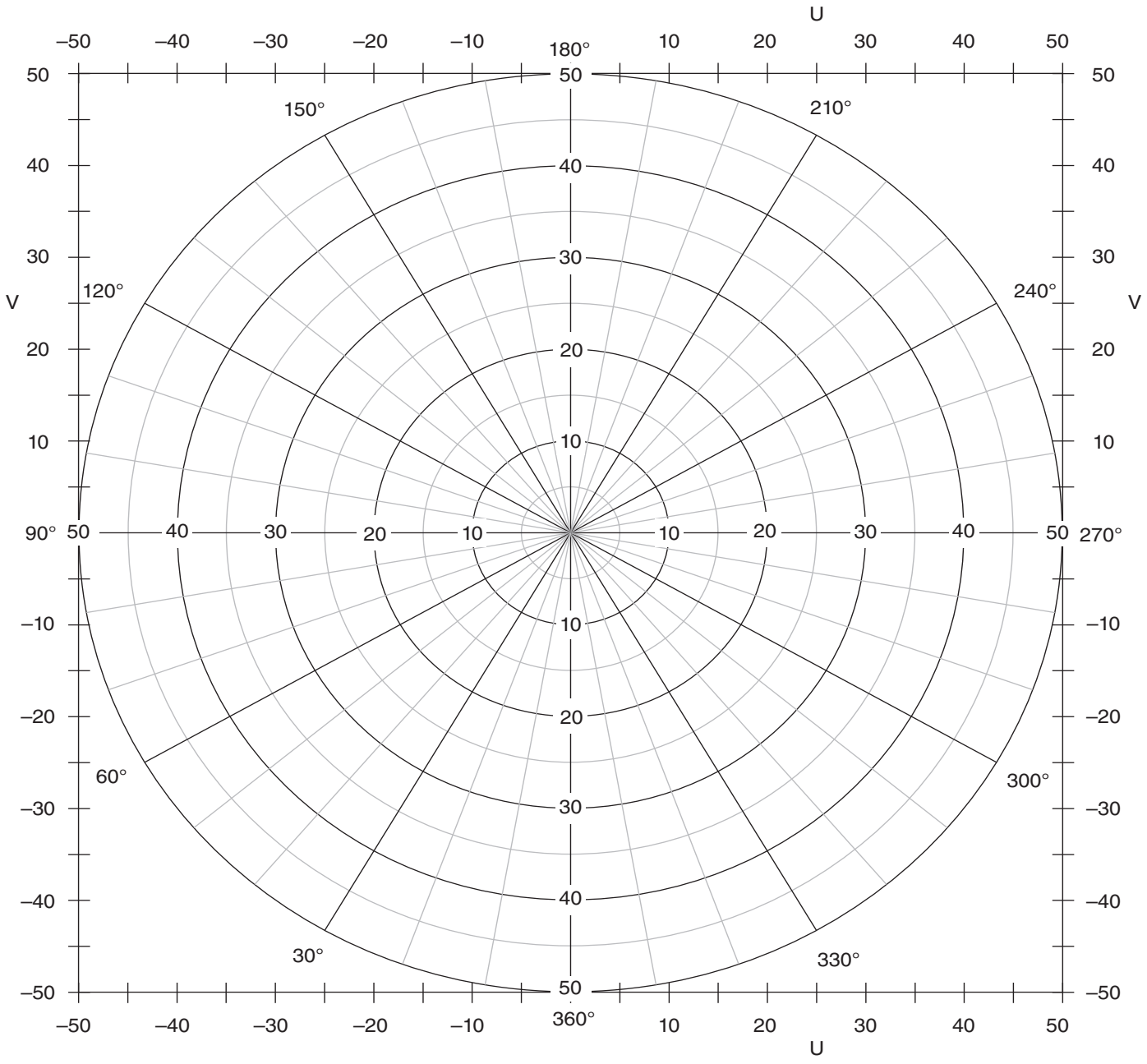
• State lines are thin.
• Process lines are thick, and are labeled with temperature where they cross P = 100 kPa.
(θw = wet-bulb potential temp.)
θ
θw
T
°C
Mixing Ratio (g/kg)
0.1
0.15
0.2
0.3
0.4
0.6
0.8
1.0
1.5
2
3
4
6
50°C
60°C
70°C
80°C
90°C
100°C
Dry Adiabat θ
Moist Adiabat θw
8
10
15
20
25
30
40
50
(g/kg)
−90°C
−80°C
−70°C
−60°C Isotherm T
Pressure (kPa)
20
30
40
50
60
70
80
90
100
Height (km)
12
11
10
9
8
7
6
5
4
3
2.5
2
1.5
1
0.5
0
−50
−40
−30
−20
−10
0
10
20
30
40
Temperature (°C)


U
V
180°
150°
210°
120°
240°
90°
270°
60°
300°
30°
330°
360°
–50 –40 –30 –20 –10 10 20 30 40 50

.

LAST NAME

A A A A A A A A A A A
B B B B B B B B B B B
C C C C C C C C C C C
D D D D D D D D D D D
E E E E E E E E E E E
F F F F F F F F F F F
G G G G G G G G G G G
H H H H H H H H H H H
I I I I I I I I I I I
J J J J J J J J J J J
K K K K K K K K K K K
L L L L L L L L L L L
M M M M M M M M M M M
N N N N N N N N N N N
O O O O O O O O O O O
P P P P P P P P P P P
Q Q Q Q Q Q Q Q Q Q Q
R R R R R R R R R R R
S S S S S S S S S S S
T T T T T T T T T T T
U U U U U U U U U U U
V V V V V V V V V V V
W W W W W W W W W W W
X X X X X X X X X X X
Y Y Y Y Y Y Y Y Y Y Y
Z Z Z Z Z Z Z Z Z Z Z

FIRST NAME

A A A A A A A A
B B B B B B B B
C C C C C C C C
D D D D D D D D
E E E E E E E E
F F F F F F F F
G G G G G G G G
H H H H H H H H
I I I I I I I I
J J J J J J J J
K K K K K K K K
L L L L L L L L
M M M M M M M M
N N N N N N N N
O O O O O O O O
P P P P P P P P
Q Q Q Q Q Q Q Q
R R R R R R R R
S S S S S S S S
T T T T T T T T
U U U U U U U U
V V V V V V V V
W W W W W W W W
X X X X X X X X
Y Y Y Y Y Y Y Y
Z Z Z Z Z Z Z Z

ID NUMBER

0 0 0 0 0 0 0 0
1 1 1 1 1 1 1 1
2 2 2 2 2 2 2 2
3 3 3 3 3 3 3 3
4 4 4 4 4 4 4 4
5 5 5 5 5 5 5 5
6 6 6 6 6 6 6 6
7 7 7 7 7 7 7 7
8 8 8 8 8 8 8 8
9 9 9 9 9 9 9 9

TEST FORM

A B C D

1 A B C D E
2 A B C D E
3 A B C D E
4 A B C D E
5 A B C D E
6 A B C D E
7 A B C D E
8 A B C D E
9 A B C D E
10 A B C D E
11 A B C D E
12 A B C D E
13 A B C D E
14 A B C D E
15 A B C D E
16 A B C D E
17 A B C D E
18 A B C D E
19 A B C D E
20 A B C D E
21 A B C D E
22 A B C D E
23 A B C D E
24 A B C D E
25 A B C D E
26 A B C D E
27 A B C D E
28 A B C D E
29 A B C D E
30 A B C D E
31 A B C D E
32 A B C D E
33 A B C D E
34 A B C D E
35 A B C D E
36 A B C D E
37 A B C D E
38 A B C D E
39 A B C D E
40 A B C D E
41 A B C D E
42 A B C D E
43 A B C D E
44 A B C D E
45 A B C D E
46 A B C D E
47 A B C D E
48 A B C D E
49 A B C D E
50 A B C D E
51 A B C D E
52 A B C D E
53 A B C D E
54 A B C D E
55 A B C D E
56 A B C D E
57 A B C D E
58 A B C D E
59 A B C D E
60 A B C D E
61 A B C D E
62 A B C D E
63 A B C D E
64 A B C D E
65 A B C D E
66 A B C D E
67 A B C D E
68 A B C D E
69 A B C D E
70 A B C D E
71 A B C D E
72 A B C D E
73 A B C D E
74 A B C D E
75 A B C D E
76 A B C D E
77 A B C D E
78 A B C D E
79 A B C D E
80 A B C D E
81 A B C D E
82 A B C D E
83 A B C D E
84 A B C D E
85 A B C D E
86 A B C D E
87 A B C D E
88 A B C D E
89 A B C D E
90 A B C D E
91 A B C D E
92 A B C D E
93 A B C D E
94 A B C D E
95 A B C D E
96 A B C D E
97 A B C D E
98 A B C D E
99 A B C D E
100 A B C D E